



NuMI Commissioning Workshop

- **Workshop Goals**
- **Project Overview**
- **Commissioning Phases and Goals**
- **Roles & Responsibilities**
- **Commissioning steps**
- **Final Comments**



Goals

- Develop a detailed plan to meet DOE Critical Decision 4 (Start of Operations)
- Develop a detailed plan to achieve normal beam operation at $\sim 2.5\text{E}13$ ppp (Fermilab start of operations)
- Recommendations on what should come before (e.g. systems checkout) and what should come after (e.g. $> 2.5\text{E}13$ ppp) are welcome



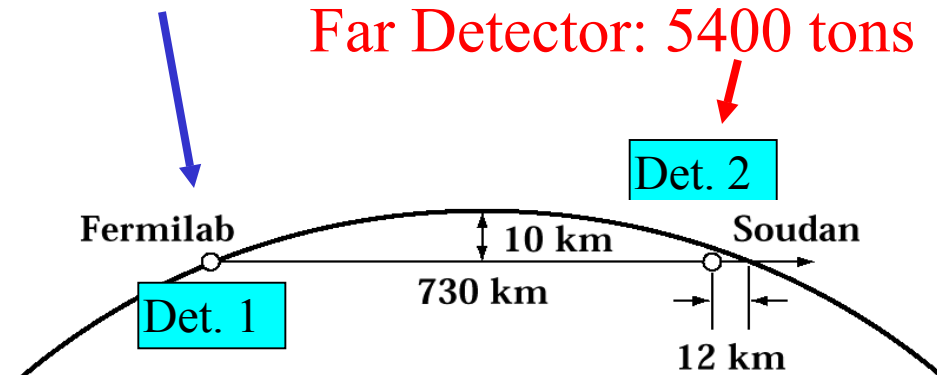
NuMI Project

Construct Facilities and Equipment for a Two Detector Neutrino Oscillation Experiment with Variable Energy Neutrino Beam

Obtain firm evidence for oscillations and measure oscillation parameters, Δm^2 , $\sin^2 2\theta$. Probe for $\nu_\mu \rightarrow \nu_e$ appearance.

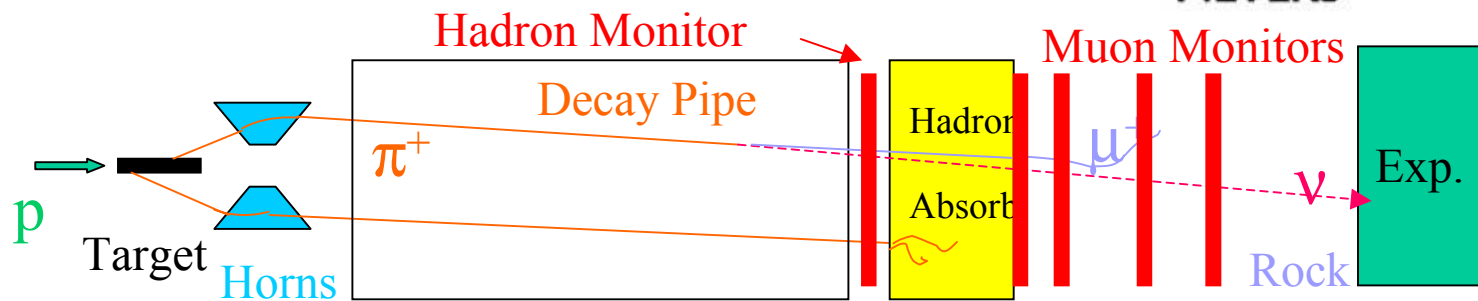
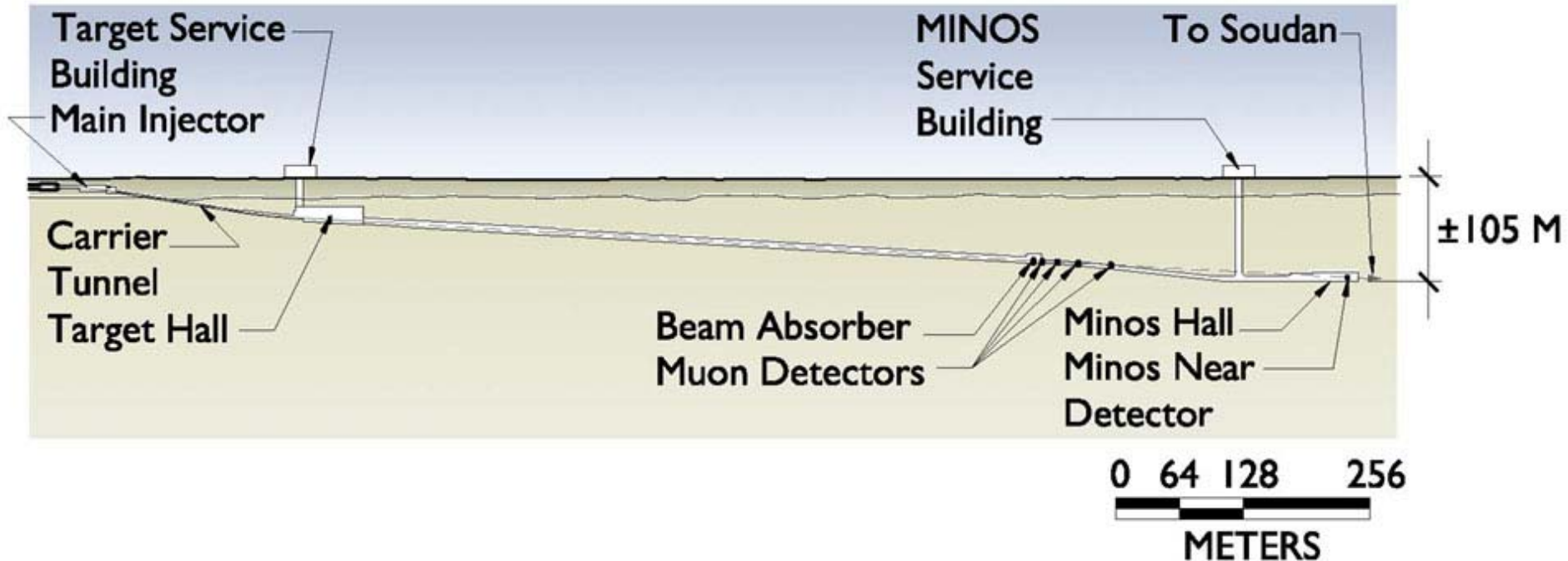
Near Detector: 980 tons

Far Detector: 5400 tons





NuMI Facility





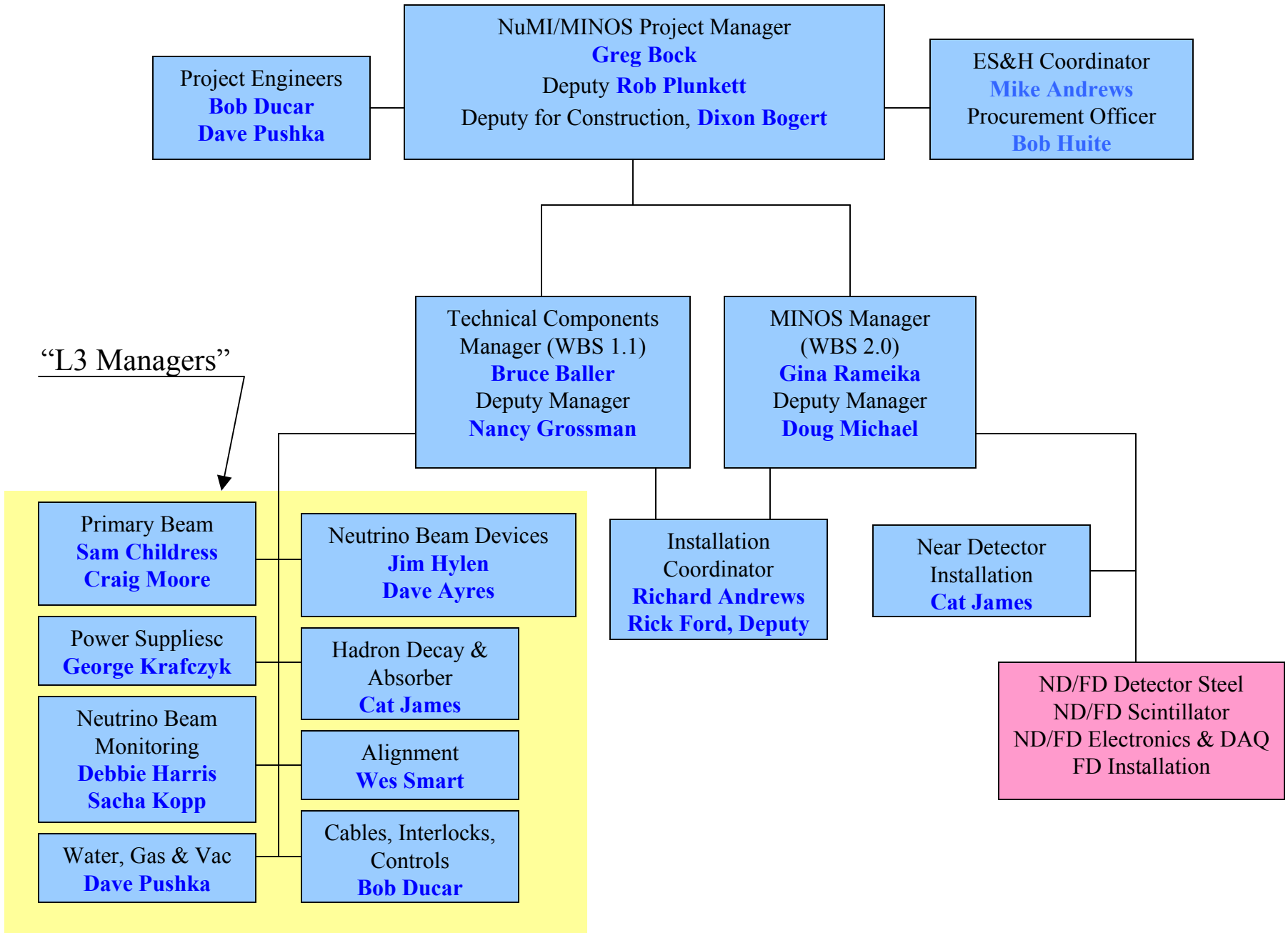
Commissioning Phases

- Systems checkout
 - « Sam Childress & Craig Moore will give an overview of selected NuMI systems
 - « Peter Shanahan will present MINOS Near Detector readiness
- Main Injector studies to support NuMI operation
 - « Alberto Marchionni will give an overview
- Beam commissioning to meet CD-4 goals
 - « Low intensity beam, observation of neutrinos in the Near Detector
- Beam commissioning for near term physics data taking
 - « Beam operations transfer to Operations Group
- Path to higher intensity



CD-4 Goals

Goal	Parameter	Measurement	Commissioning Goal	WBS
1	Proton intensity in target hall	Toroid (or equivalent) beam intensity at entrance to the Target Hall	Greater than 1E12 120 GeV protons/spill	1.1
2	Beam alignment	Transverse distributions of the proton beam and secondary beams	Proton direction established to within 1 mr of the known direction to the Far Detector in the Soudan mine.	1.1
3	Neutrino beam energy	Near detector event energy	Low energy, 2-4 GeV	1.1, 2.0
4	Cosmic ray muons detected in the MINOS near detector	Near detector data read out through DAQ system	Majority of 153 near detector planes sensitive to muons	2.0
5	Near detector neutrino flux	Charged current event rate in 1.5 ton fiducial region	Observer neutrinos in the near detector produced by the NuMI beam	1.1, 2.0
6	Cosmic ray muons and atmospheric neutrinos detected in each of the two MINOS far detector super-modules	Far detector data read out through DAQ system	Majority of the 484 planes of the far detector sensitive to muons and atmospheric neutrinos	2.0





Project Roles & Responsibilities

NuMI Commissioning
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- Technical Components L3 Managers are responsible for providing an operating system (design, procure, assembly, checkout, installation technical oversight, commissioning)
- ND Installation Manager = L3 Manager – commissioning + MINOS collaboration
- Installation Coordinators are responsible for installation scheduling and work planning



Commissioning Roles & Responsibilities

NuMI Commissioning

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- The NuMI Project is responsible for commissioning
- Ensure that commissioning activities are compliant with Fermilab and DOE requirements and goals
- Schedule these activities to maximize efficiency and minimize impact to accelerator operations
 - « NuMI Commissioning Coordinator – Bruce Baller
 - « MINOS Near Detector Commissioning Coordinator – Peter Shanahan

Step	Description	Purpose	Special Req'mnts	Proton Intensity (ppp)	Cycle Time (sec)	Profile Mon	Tgt Pos	Horn Status	ND neutrinos/hr/100T	Approx Dur (days)	Day	CD-4 Goal
1	Main Injector setup	NuMI single batch setup. Ramp timing, Autotune validation	NuMI enabled. Kicker off. 2 turns 30 bunches	3.E+11	60	In	Out	Off	0	0.5	0.5	
2	First beam to NuMI	Beam tuning to observe beam profiles	No below ground access	3.E+11	60	In	Out	Off	0	1	1.5	
3	Aperture Scan	Check transport apertures & transport matrix	No below ground access	3.E+11	60	In	Out	Off	0	1	2.5	
4	Horn Alignment	Check horn alignment with beam scan & tgt pit LM	No below ground access	3.E+11	60	In	Out	Off	0	0.5	7.5	
5	Target/Baffle Alignment - LE	Check target/baffle alignment with beam scan & tgt pit LM	No below ground access	3.E+11	60	In	LE	Off	0	0.5	8.5	
6	Raise intensity	Observe hadron monitor beam profile. Check magnet ramp timing	No below ground access	1.E+12	60	In	Out	Off	0	1	3.5	1,2
7	Calibration & first neutrinos	Calibrate loss monitors & BPM's. Check horn timing with pit loss monitor?	No below ground access	1.E+12	60	In/Out	ME	On	8	1	4.5	3,5
8	BPS tuning	Tighten BPS inputs	No below ground access	1.E+12	60	Out	ME	On	0	1	5.5	
9	Rad Surveys	Check dose rates in occupied areas	BPS trip on high intensity/loss -> STD XPRT	1.E+12	60	Out	ME	On	8	0.5	6	
10	Monitor position sensitivity	Check BPM, profile monitor, target, baffle, mu mon & had monitor sensitivity	BPS STD XPRT	1.E+12	60	In	ME	Off	0	1	7	
11	Target/Baffle Alignment - ME	Check target/baffle alignment with beam scan & tgt pit LM	BPS STD XPRT	3.E+11	60	In	ME	Off	0	0.5	8	
12	BPS tuning	Add tgt/baffle/horn inputs to BPS. Define "baseline running conditions"	BPS STD	1.E+12	60	Out	LE	On	5	0.5	9	
13	Multi-batch tuning	Establish Main Injector multi-batch operation. Check NuMI transport & optics	BPS STD	5.E+12	60	Out	LE	On	26	5	14	
14	Reduce cycle time	Establish standard NuMI cycle time	BPS STD	5.E+12	2	Out	LE	On	783	5	19	



Final Comments

- We invite your comments on these dimensions to commissioning
 - « Technical issues
 - * Recommendations for checkout steps, potential interferences between NuMI, Run II, SY120
 - « Administrative requirements
 - * Approvals, documentation
 - « Safety
 - * The NuMI Safety Assessment Document & Shielding Assessment assume that systems are functioning correctly
 - « Human factors
 - * Qualifications of the commissioning team
 - * Intensity – frenzied/sedate
- We hope to incorporate any lessons learned from your previous experience